

We claim:

1. A catalyst for methylating a naphthalenic feedstock, said catalyst comprising:

a zeolitic material incorporating Al and one or more additional metals selected from the group consisting of Fe, Ga, Ti and Co, and mixtures thereof, wherein the ratio of the additional metal(s) to Al is between about 1:10 and 3:1.

2. The catalyst of Claim 1 wherein there is a single additional metal, and the additional metal is Fe.

3. The catalyst of Claim 1 wherein at least fifty mole percent of the additional metal is incorporated into the zeolitic lattice structure.

4. The catalyst of Claim 3 incorporating a single additional metal, and the additional metal is Fe.

5. The catalyst of Claim 1 wherein the catalyst is a metallosilicate prepared by isomorphic substitution of Al by one or more additional metals.

6. The catalyst of Claim 5 wherein the metallosilicate is prepared by isomorphic substitution of Al by a single additional metal, and wherein the ratio of the single additional metal to Al is between about 0.16:1 and 2.9:1.

7. The catalyst of Claim 6 wherein the single additional metal is Fe.

8. The catalyst of Claim 7 wherein the ratio of Fe to Al is between 0.16:1 and 1.75:1.

9. The catalyst of Claim 1 further including between 5 and 95 weight percent of a binder.

10. The catalyst of Claim 9 wherein the binder is selected from the group consisting of binders comprising boehmite, alkali earth metals and SiO_2 .

11. The catalyst of Claim 1 further including between 0.01 and 5 weight percent of a noble metal.

12. The catalyst of Claim 9 further including between 0.01 and 5 weight percent of a noble metal.

13. The catalyst of Claim 11 wherein the noble metal is selected from the group consisting of platinum, palladium, rhodium, iridium and ruthenium, and wherein the catalyst includes a single additional metal, the single additional metal is Fe, and the ratio of Fe to Al is between 0.16:1 and 1.75:1.

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14. The catalyst of Claim 12 wherein the weight percent of the noble metal is between 0.05 and 2.0 weight percent of the total catalyst weight.

15. The catalyst of Claim 7 wherein the catalyst includes 20 to 80 weight percent boehmite binder, wherein 0.5 to 2.0 weight percent of a noble metal is deposited on the binder, calculated as weight percent of binder plus noble metal.

16. The catalyst of Claim 1 where the zeolitic material is a ZSM-5 type aluminosilicate.

17. The catalyst of Claim 3 where the zeolitic material is a ZSM-5 type aluminosilicate.

18. The catalyst of Claim 5 where the zeolitic material is a ZSM-5 type aluminosilicate.

19. The catalyst of Claim 7 where the zeolitic material is a ZSM-5 type aluminosilicate.

20. The catalyst of Claim 9 where the zeolitic material is a ZSM-5 type aluminosilicate.

21. The catalyst of Claim 1 wherein the zeolitic material is selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-22, MCM-22, ZSM-23, ZSM-39, ZSM-57, mordenite, Beta, FAU, L-types, and mixtures thereof.

22. A process for preparing an isomorphically substituted zeolitic catalyst comprising the steps of:

selecting an aluminosilicate zeolitic material selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-22, MCM-22, ZSM-23, ZSM-39, ZSM-57, mordenite, Beta, FAU, and L-types; and

refluxing a slurry of the zeolitic material in the presence of a soluble metal compound selected from the group consisting of metal compounds of Fe, Ga, Ti and Co and mixtures thereof under conditions effective for substituting aluminum in the aluminosilicate zeolitic material with metal from the soluble metal compound to yield a metal to aluminum ratio of between 1:10 and 3:1.

23. The process of Claim 22 wherein the refluxing is conducted in the presence of a soluble hydrogen fluoride salt.

24. The process of Claim 23 wherein the soluble hydrogen fluoride salt is NH_4HF_2 .

25. The process of Claim 23 wherein the soluble metal compound is selected from the group consisting of metal fluoride compounds.

26. The process of Claim 22 wherein the zeolitic material is a ZSM-5 type material.

5 27. The process of Claim 26 wherein the soluble metal compound is FeF_3 and wherein the refluxing is conducted in the presence of a soluble hydrogen fluoride salt

28. A process for methylating a naphthalenic feedstock in the presence of a methyl group donor under methylation conditions in the presence of a catalyst prepared by substituting Al in a zeolitic aluminosilicate material selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-22, MCM-22, ZSM-23, ZSM-39, ZSM-57, mordenite, Beta, FAU, and L-types with a metal selected from the group consisting of Fe, Ga, Ti and Co, and mixtures thereof.

15 29. The process of Claim 28 wherein the catalyst is prepared by isomorphically substituting aluminum in a ZSM-5 type material with Fe, and wherein the catalyst has a Fe to Al ratio between about 1:10 and 2.9:1.

30. The process of Claim 28 wherein the naphthalenic feed stock to methyl group donor ratio is between 7:1 and 1:5.

31. The process of Claim 28 wherein the naphthalenic feed stock is selected from the group consisting of naphthalene and 2-methyl naphthalene.

20 32. The process of Claim 28 wherein the methyl group donor is selected from the group consisting of methanol and dimethyl ether.

33. The process of Claim 28 wherein the process is carried out at a weight hourly space velocity of from 1.4 and 23h^{-1} and a temperature between about 200 and 450°C .

25 34. The process of Claim 28 wherein the naphthalenic feed stock to methyl group donor ratio is between 7:1 and 1:5, wherein the naphthalenic feed stock is selected from the group consisting of naphthalene and 2-methyl naphthalene, wherein the methyl group donor is selected from the group consisting of methanol and dimethyl ether, and wherein the process is carried out at a weight hourly space velocity of from 1.4 and 23h^{-1} and a temperature between about 200 and 450°C .

30 35. The process of Claim 34 wherein the naphthalenic feedstock is 2-methyl naphthalene and the methyl group donor is methanol.

36. The process of Claim 34 wherein the catalyst includes between 0.01 and 5 weight percent of a noble metal.

37. The process of Claim 28 wherein the catalyst is the catalyst of Claim 9.

38. The process of Claim 28 wherein the catalyst is the catalyst of Claim

5 15.

39. The catalyst of Claim 1 wherein a portion of acid catalyst sites in the catalyst have been intentionally deactivated prior to use of the catalyst in an alkylation reaction.

40. The catalyst of Claim 15 wherein a portion of acid catalyst sites in the catalyst have been intentionally deactivated prior to use of the catalyst in an alkylation reaction.

41. The process of Claim 34 wherein the catalyst has had a portion of acid catalyst sites deactivated by treating the zeolitic material comprising the catalyst with a silicon-containing compound, with a basic nitrogen compound, with a phosphorous-containing compound, or by treating the zeolitic material with NH_4SiF_6 .

42. A catalyst formed by substituting Fe for Al in an alumino-silicate zeolytic matrix in which the Fe to Al ratio in a resulting metallosilicate matrix is from between about 1:10 to 3:1.

43. The catalyst of Claim 42 in which the alumino-silicate zeolytic matrix is of the ZSM-5 type.

44. The catalyst of Claim 43 further including between 0.1 and 5 weight percent of a noble metal selected from the group consisting of platinum, palladium or mixtures thereof deposited on the catalyst.

25